

Experiment No: 07

Experiment Name: Experiment of DHCP using IOS CLI.

Theory:

The Dynamic Host Configuration Protocol (DHCP) is a fundamental network protocol that automatically assigns IP addresses and network configuration parameters (Subnet Mask, Gateway) to clients, preventing IP conflicts and reducing manual effort.

The four-step address acquisition process is known as DORA: Discover (client finds server), Offer (server proposes IP), Request (client accepts IP), and Acknowledge (server confirms lease).

Components:

1. Cisco Packet Tracer.
2. PT-Routers.
3. PT-Switches.
4. Desktops/Laptops.
5. Connection cables.

Procedure:

The lab involved two distinct tasks to demonstrate DHCP functionality in escalating network complexity.

Task 1: Two-Subnet Setup using DHCP.

1. This setup utilized a single central router to serve two subnets: 192.168.1.0/24 and 192.168.2.0/24.
2. Placed 1 Router, 2 Switches, and 6 PCs. Established physical connections.
3. Configured and activated Fast Ethernet interfaces as the Default Gateways for the two LANs.
 - FastEthernet0/0 IP: 192.168.1.1
 - FastEthernet1/0 IP: 192.168.2.1

```
dhcp-server>en
dhcp-server#conf t
Enter configuration commands, one per line. End with CNTL/Z.
dhcp-server(config)#int fa 0/0
dhcp-server(config-if)#ip add 192.168.1.1 255.255.255.0
dhcp-server(config-if)#no shut
dhcp-server(config-if)#int fa 1/0
dhcp-server(config-if)#ip add 192.168.2.1 255.255.255.0
dhcp-server(config-if)#no shut
dhcp-server(config-if)#
```

Figure 01: Fast Ethernet Value Input by CLI.

- Defined two DHCP pools on the Router (DHCP-LAN1, DHCP-LAN2), specifying the network, default router, and DNS for each.

```
Router(config)#hostname dhcp-server
dhcp-server(config)#ip dhcp excluded-address 192.168.1.1
dhcp-server(config)#ip dhcp excluded-address 192.168.2.1
dhcp-server(config)#ip dhcp pool net1
dhcp-server(dhcp-config)#network 192.168.1.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.1.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#ip dhcp pool net2
dhcp-server(dhcp-config)#network 192.168.2.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.2.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#exit
dhcp-server(config)#
```

Figure 02: DHCP Configuration by CLI.

- Set all 6 PCs to use the DHCP client option for automatic configuration.

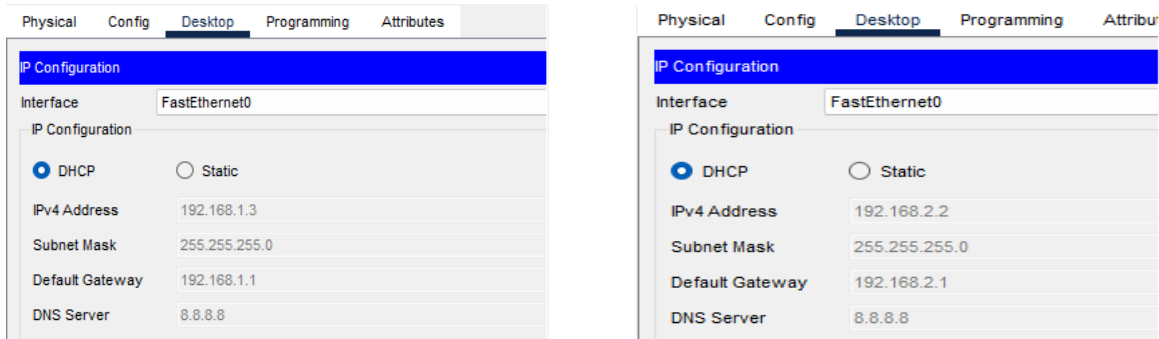


Figure 03: Auto IP Configuration by DHCP.

- Confirmed successful IP allocation (e.g., 192.168.1.2 onward and 192.168.2.2 onward). Executed ping tests for both intra-subnet and inter-subnet connectivity.

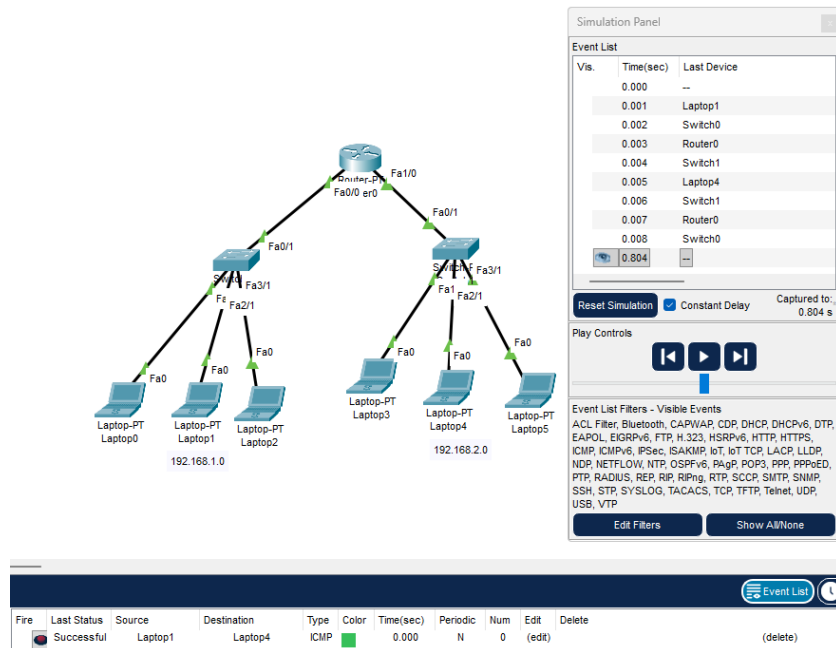


Figure 04: 1 Router 2 Switches Connection by DHCP.

Task 2: Multi-Router Network setup using DHCP and RIP.

This expanded setup utilized multiple DHCP servers across several routers and required the use of RIP for dynamic routing between the interconnected LANs (e.g., 192.168.10.0, 192.168.11.0, 192.168.20.0, 192.168.30.0, etc.).

1. Placed 3 Routers, Switches/PCs, including serial connections (192.168.100.0/30 and 192.168.200.0/30 links).

```
dhcp-server>en
dhcp-server#conf t
Enter configuration commands, one per line. End with CNTL/Z
dhcp-server(config)#int se2/0
dhcp-server(config-if)#ip add 192.168.100.1 255.255.255.0
dhcp-server(config-if)#no shut

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
dhcp-server(config-if)#int se3/0
dhcp-server(config-if)#ip add 192.168.200.1 255.255.255.0
dhcp-server(config-if)#no shut

dhcp-server#en
dhcp-server#conf t
Enter configuration commands, one per line. End with CNTL/Z
dhcp-server(config)#int se3/0
dhcp-server(config-if)#ip add 192.168.200.2 255.255.255.0
dhcp-server(config-if)#no shut

dhcp-server(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
dhcp-server(config-if)#int se/0
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed
dhcp-server(config-if)#int se2/0
dhcp-server(config-if)#ip add 192.168.250.2 255.255.255.0
dhcp-server(config-if)#no shut

dhcp-server#en
dhcp-server#conf t
Enter configuration commands, one per line. End with CNTL/Z
dhcp-server(config)#int se3/0
dhcp-server(config-if)#ip add 192.168.250.1 255.255.255.0
dhcp-server(config-if)#no shut

dhcp-server(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
dhcp-server(config-if)#ip add 192.168.250.1 255.255.255.0
dhcp-server(config-if)#no shut
```

Figure 05: Serial Connection by CLI.

2. Configured all LAN interfaces (e.g., 192.168.10.1) and all Serial interfaces for inter-router communication.

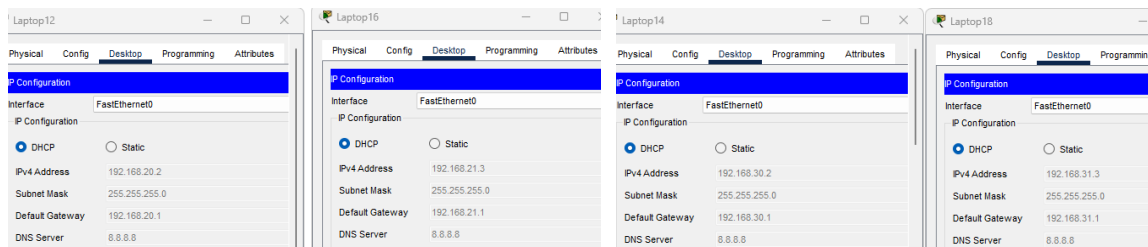


Figure 06: Auto DHCP Configuration.

3. DHCP Server Configuration Configured Fast Ethernet interfaces as default gateways and created six DHCP pools across the three routers to cover all directly connected LAN segments.
4. Ensured all 14 PCs were configured as DHCP clients.

```
Router(config)#hostname dhcp-server
dhcp-server(config)#ip dhcp excluded-address 192.168.20.1
dhcp-server(config)#ip dhcp excluded-address 192.168.21.1
dhcp-server(config)#ip dhcp pool net3
dhcp-server(dhcp-config)#network 192.168.20.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.21.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#ip dhcp pool net4
dhcp-server(dhcp-config)#network 192.168.20.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.20.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8

Router(config)#hostname dhcp-server
dhcp-server(config)#ip dhcp excluded-address 192.168.10.1
dhcp-server(config)#ip dhcp excluded-address 192.168.11.1
dhcp-server(config)#ip dhcp pool net5
dhcp-server(dhcp-config)#network 192.168.10.0 255.255.255.0
Invalid input detected at '' marker.
dhcp-server(dhcp-config)#network 192.168.10.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.10.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#ip dhcp pool net6
dhcp-server(dhcp-config)#network 192.168.11.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.11.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#

Router(config)#hostname dhcp-server
dhcp-server(config)#ip dhcp excluded-address 192.168.31.1
dhcp-server(config)#ip dhcp excluded-address 192.168.30.1
dhcp-server(config)#ip dhcp pool net7
dhcp-server(dhcp-config)#network 192.168.30.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.30.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
dhcp-server(dhcp-config)#ip dhcp pool net8
dhcp-server(dhcp-config)#network 192.168.31.0 255.255.255.0
dhcp-server(dhcp-config)#default-router 192.168.31.1
dhcp-server(dhcp-config)#dns-server 8.8.8.8
```

Figure 07: DHCP Configuration by CLI.

- Dynamic Routing Configuration Enabled the RIP routing protocol on all three routers and advertised every directly and indirectly connected network (LAN and Serial).

ROUTING	
Static	
RIP	
INTERFACE	
FastEthernet0/0	192.168.10.0
FastEthernet1/0	192.168.11.0
Serial2/0	192.168.20.0
Serial3/0	192.168.21.0
FastEthernet4/0	192.168.30.0
FastEthernet5/0	192.168.31.0
	192.168.100.0
	192.168.200.0
	192.168.250.0

Figure 08: RIP Configuration.

- Executed ping tests between distant PCs (e.g., 192.168.10.0 network to 192.168.30.0 and 192.168.30.0 network to 192.168.20.0 network) to confirm end-to-end communication, validating DHCP and RIP operation.

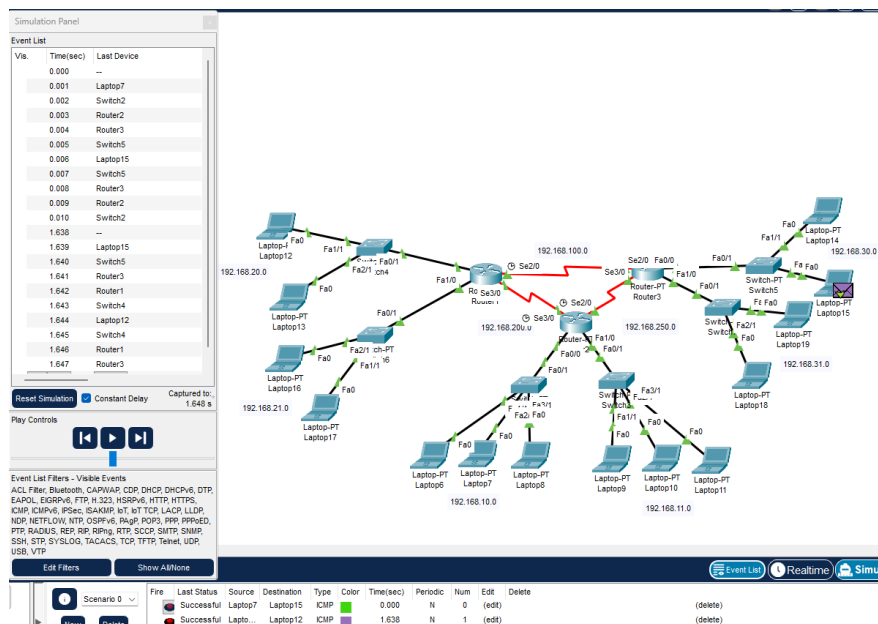


Figure 09: Multi-Router Network Configuration by DHCP and RIP.

Conclusion:

The experiment successfully utilized DHCP for centralized, automatic IP address management across both simple and multi-router topologies. Verification confirmed the DORA process functioned correctly. Integrating DHCP with the RIP routing protocol provided a complete, scalable solution, validating seamless end-to-end communication across all configured subnets.